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<b>(21) International Application Number:</b> PCT/SE95/01075 <b>(22) International Filing Date:</b> 21 September 1995 (21.09.95)  <b>(30) Priority Data:</b> 9403343-8                      4 October 1994 (04.10.94)                      SE  <b>(71) Applicant (for all designated States except US):</b> TELIA AB [SE/SE]; S-123 86 Farsta (SE).  <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> HAGSTRÖM, Bengt [SE/SE]; Vivelvägen 19, S-125 33 Älvsjö (SE).  <b>(74) Agent:</b> KARLSSON, Berne; Telia Research AB, Rudsjöterrassen 2, S-136 80 Haninge (SE).		<b>(81) Designated States:</b> US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

**(54) Title:** DEVICE FOR CONTROL OF THE CAPACITY OF A TELECOMMUNICATION NETWORK**(57) Abstract**

The present invention relates to a device at telecommunication networks for control of the capacity in the different parts of the telecommunication network. The different parts of the telecommunication network consist for instance of radio link connection, coax-connection, fiber connection etc. In the border area between each area, channel creating devices are arranged. The channel creating devices communicate with centrally arranged control devices. The control devices gather information from the different parts of the telecommunication network regarding need of information transmission. The control device after that decides which channels that shall be used and how these shall be allocated in the network. The information is transferred to the channel creating devices which communicates with frequency separation mechanisms in the telecommunication network. Further, the direction in which the information is to be directed in the network is controlled. The invention accordingly allows that the capacity of the telecommunication network is flexibly usable in its entirety as well as in parts of the network.

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## TITLE OF THE INVENTION

Device for control of the capacity of a  
telecommunication network.

5

## TECHNICAL FIELD

The present invention relates to a telecommunication  
10 network which is divided into a number of parts. The  
different parts can comprise different kinds of  
transmission media, for instance radio link connection,  
coax-connection, fiber optic connection etc. In future  
telecommunication networks ring networks will be  
15 established, at which different network structures will  
be interconnected. The transmission capacity in the  
different parts of the network varies.

## 20 PRIOR ART

The capacity in the telecommunication networks of today  
is statically allotted. This implies that channels in  
the network are arranged according to an anticipated  
25 need. The implication of this is that the channel use is  
arranged independent of the need existing in each  
moment. Furthermore the channels are allotted determined  
traffic directions. The consequence of this is that a  
connection can have free channel space which is not  
30 possible to use because the traffic direction of the  
channels do not correspond to the wanted traffic  
direction. In the telecommunication networks of to-day  
the information is furthermore transmitted in a  
spiderweb-similar network. By the patent document US 4  
35 298 979 it is previously known to change channel  
allocation in interface modules by a request allocation

process. A central network control unit registers all capacity- and destination wishes which are possible to transmit to the network stations. The network stations are further connected to a central station which  
5 communicates with a satellite. The communication relates to transmission of data at fixed points of time and between fixed points.

## 10 DESCRIPTION OF THE INVENTION

### TECNICAL PROBLEM

At information transmission in a network there is a need  
15 to use the capacity in the different parts of the network efficiently. At this there exist wishes that the capacity can be changed depending on the existing need. Beside the possibility to change the capacity in the network there is also a need to decide the transmission  
20 direction for different capacities.

In the telecommunication networks which are built to-day different media will be used in the network. Accordingly all today known transmission media will be used, as well  
25 as future media which are not yet known. Depending on usable capacity also different paths to one and the same goal shall be possible to use depending on which path that will give the wanted capacity need. Further is aimed at network structures where loss of capacity in  
30 parts of the network does not paralyse big parts of the network without alternative transmission paths being used.

Furthermore there exists need to allocate channels  
35 independent of each other. Further, there are wants for possibility to change channel allocation while

communication is going on with regard to the actual need.

The present invention intends to solve the above  
5 mentioned problems.

#### THE SOLUTION

10 The present invention relates to a device for control of the capacity in a telecommunication network. The telecommunication network, which preferably is a ring network, comprises a number of parts. The parts which  
15 can consist of different media, for instance coax, fiber, radio link etc., has each a transmission capacity which is depending on the media. The transmission capacity in the different parts of the network are known. Centrally in the network is arranged a control function which in each moment decides the capacity need in the  
20 different parts of the network. The control function is arranged to flexibly allocate the parts of the network that transmission capacity which is required at the moment. The control function is further arranged to communicate with channel creating devices in the  
25 telecommunication network and the channel creating devices are controlled by the control function.

In a further development of the invention the channel creating devices are arranged to establish channels for  
30 communication in different parts of the network. The creation of channels by the channel creating devices and traffic allocations in the channels are controlled by the control function. The channel creating devices are further arranged to control frequency separation  
35 mechanisms in the different parts of the telecommunication network. Furthermore the channel

creating devices are preferably linked in the borders between different parts of the telecommunication network. The telecommunication network is further arranged in the form of a ring network.

5

#### ADVANTAGES

The invention allows that the capacity of the network can be used in an efficient and optimal way. Further the invention allows that the transmission direction is selectable depending on the existing need. The invention further allows that the capacity in the different parts of the network is variable. Possibility is further given to allocate channels, frequencies, depending on the existing need. Furthermore the channels can be reallocated between different parts of the network without these influencing each other.

The channel allocation and traffic direction is consequently possible to implement in the different parts of the network, independent of each other. The ring network structure further gives a flexible use of the network by the possibility to reroute the traffic at network fault. The elimination risk, which in conventional networks strikes many subscribers in the network, is drastically reduced.

#### 30 DESCRIPTIONS OF FIGURES

Figure 1 shows a ring network where A, B, C, D and E shows different parts of the network.

35 Figure 2 shows in a corresponding way a network divided into parts with centrally arranged control device.

Figure 3 shows a part of the network with channel creating devices arranged in the border between the different parts of the network.

5

Figure 4 shows corresponding to Figure 3 with frequency separation mechanisms indicated.

## 10 PREFERRED EMBODIMENT

In the following the invention is described on the basis of the figures. A telecommunication network according to Figure 1 is arranged. The invention relates to a device  
15 at telecommunication network for control of the different parts of the telecommunication network. The different parts consist for instance of coax connections, fiber connections, radio link connections etc. Channel creating device is arranged in the border  
20 between each part of the network. A centrally arranged control device is arranged to communicate with the channel creating devices. The control device gathers its information from the different parts of the telecommunication network regarding the information  
25 transmission need. A decision, by the control device, is after that made regarding which channels that shall be used and their allocation in the network. The channel creating devices receive the information and communicate with the frequency separation mechanism in the  
30 telecommunication network. The traffic direction in the network is further controlled. The telecommunication network is divided into a number of parts A, B, C etc. Each part of the telecommunication network has individual properties. Accordingly part A can correspond  
35 to a coaxial connection, part B to a fiber optical connection and C to a radio link connection etc. In the

coaxial connection respective fiber connection the transmission capacity is limited by the properties of respective media. The properties which at that are to be observed are respective cable's frequency limitations and at that possibility to divide into a number of different channels. In part C, where a radio link transmission is established, the transmission capacity is limited by the available frequency space in the ether. Further the frequency space is limited by the risk for disturbances from adjacent radio transmissions. The available frequency space in the ether can vary during the different parts of the 24, hours depending on the grade of use of other radio transmissions within the range where the radio link transmission can be disturbed, or disturb.

In the border between the different parts of the network channel creating devices are arranged. These channel creating devices are allowed to communicate on one hand with the own network, on the other with users in the network or with other networks. The changeover to other networks or users in the network can also be connected to the network parts in other points than here indicated. In Figure 3, where the channel creating devices have been indicated in part of the network has also been indicated the possibility to connect other networks or user to the channel creating devices. In Figure 2, a central control device, S, has been indicated. The control device communicate with the different parts of the network and gathers information regarding information transmission need. Further the border between the area A and area B in Figure 2 is considered. In this interface, channel creating devices and frequency separation mechanisms according to Figure 4 are arranged. Further there are means arranged which put together information regarding traffic to and from



part area A respective part area B in Figure 2, and traffic to and from other networks respective to and from users. The information comprises among other things capacity need and destination for the information in question. Further is transferred information about limitations in the network such as the free capacity space of the different parts and/or faults in the network. The information is transferred via the lined connections in Figure 2 to the control device. The control device after that determines what channel space that is needed for the information that is to be transmitted on the network. Further the control device examines which possible routes that exist with regard to the wished information space. The control device after that decides which path an information is to be routed in the network. Further the control device decides which frequencies, channels, that are to be allocated the information transmission in question in the different parts of the network. Information regarding the decided frequency allocations are transferred to the mentioned channel allocation devices in Figure 3. Information is further transferred whether respective channel shall be one-way or bi-directional, and in the cases when they are one-way what direction they shall have in the network. The allocation of channels is in this way flexibly made in the different parts of the network at which one for each occasion adapted need is fulfilled.

The channel creating devices, K, are further arranged to control frequency separation mechanisms, F, in the network. The frequency separation mechanisms have the task of sorting out the different channels which come in respective go out in respective interface in the network. The channel creating devices and the frequency separation mechanisms in other respects operate according to in itself well known methods. In the

description it has been supposed that the channel  
creating devices are arranged between parts of the  
network which in their characters are different. Any  
prevention that the channel creating devices are  
5 arranged within a part network where one and the same  
network structure exists on both sides of the channel  
creating devices does not exist.

The control device further receives information from the  
10 different parts of the network regarding limitation that  
can occur, for instance break on a connection. At break  
on a connection, for instance in part B, traffic which  
comes in in the border between part A and B to be routed  
over part distance A E D C to users or networks which  
15 are connected in the border between area B and C. In a  
corresponding way information which are to be routed  
from the border area between area B and C to the area  
between A and B will be routed over the part areas C D E  
A B. The control device will at that see that available  
20 channels are used in an efficient way and that as much  
communication as possible can be performed without  
serious disturbances in the network.

The control device further communicates continuously  
25 with the different parts of the network and analyses the  
traffic need in relation to available resources.  
Reallocation of channels are at that made depending on  
the need. Further an already established connection can  
be routed another path for making capacity, channels, in  
30 the network, available. On such occasions the control  
device receives information from the different parts of  
the network. Analysis in the control device decides  
possible reallocations of the network when a  
reallocation of channels and/or change of traffic  
35 direction or route is needed, the control device  
transmits orders to the channel creating devices, which

perform necessary changes inclusive control orders to the frequency separation mechanisms. In the case that the network is not capable of establishing all connections which are wanted on one occasion, the  
5 control device is arranged to optimize available channels for best possible use. The control device at that takes into consideration the communication transmission which has priority before others. These communications given priority to, are allocated communication space before  
10 other connections. Connections which have not been possible to establish are controlled by the control device which gives necessary information to the subscriber, via current channel creation device or other equipment in the telecommunication network. The  
15 subscriber can at that be given possibility to wait for a later connection or is given the message that he/she should try again on a later occasion.

The invention is not restricted to the above shown  
20 embodiment but can be subjected to modifications within the frame of the following patent claims and idea of invention.

## PATENT CLAIMS

1. Device for control of the capacity of a telecommunication network, which network comprises a number of parts, which parts have different transmission capacities, and the transmission capacities in the different parts of the network are known, characterized in that at least one control device is arranged in the telecommunication network, that the control devices are arranged to in each moment decide the capacity need in the different parts of the telecommunication network, and that the control devices are arranged to flexibly allocate the parts in the telecommunication network the transmission capacity which is required at the moment.

2. Device according to patent claim 1, characterized in that the control devices are centrally arranged in the telecommunication network.

3. Device according to patent claim 1 or 2, characterized in that channel creating devices are arranged in the telecommunication network.

4. Device according to any of the previous patent claims, characterized in that the control devices are arranged to communicate with the channel creating devices.

5. Device according to any of the previous patent claims, characterized in that the control devices are arranged to control the channel creating devices.

6. Device according to any of the previous patent  
claims, characterized in that the channel  
creating devices are arranged to establish channels for  
communication in the different parts of the  
5 telecommunication network.

7. Device according to any of the previous patent  
claims, characterized in that the control  
devices are arranged to control the creating of channels  
10 in the channel creating devices and traffic directions  
in the channels.

8. Device according to any of the previous patent  
claims, characterized in that the channel  
15 creating devices are arranged to control a frequency  
separation mechanism in the different parts of the  
telecommunication network.

9. Device according to any of the previous patent  
20 claims, characterized in that the different  
parts of the telecommunication network consist of  
different media, for instance coax, fiber, and/or radio  
link connection.

25 10. Device according to any of the previous patent  
claims, characterized in that the channel  
creating devices are preferably arranged in the border  
between different media.

30 11. Device according to any of the previous patent  
claims, characterized in that the  
telecommunication network is a ring network.

12. Device according to any of the previous patent  
35 claims, characterized in that the  
telecommunication network is allowed to include a number

of interacting telecommunication networks, which telecommunication networks are allowed to be conventional telecommunication networks and/or ring networks.

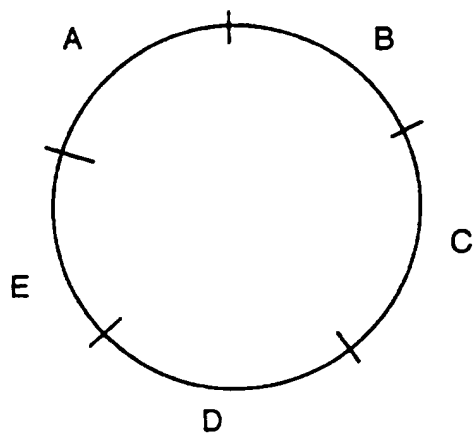


Fig. 1

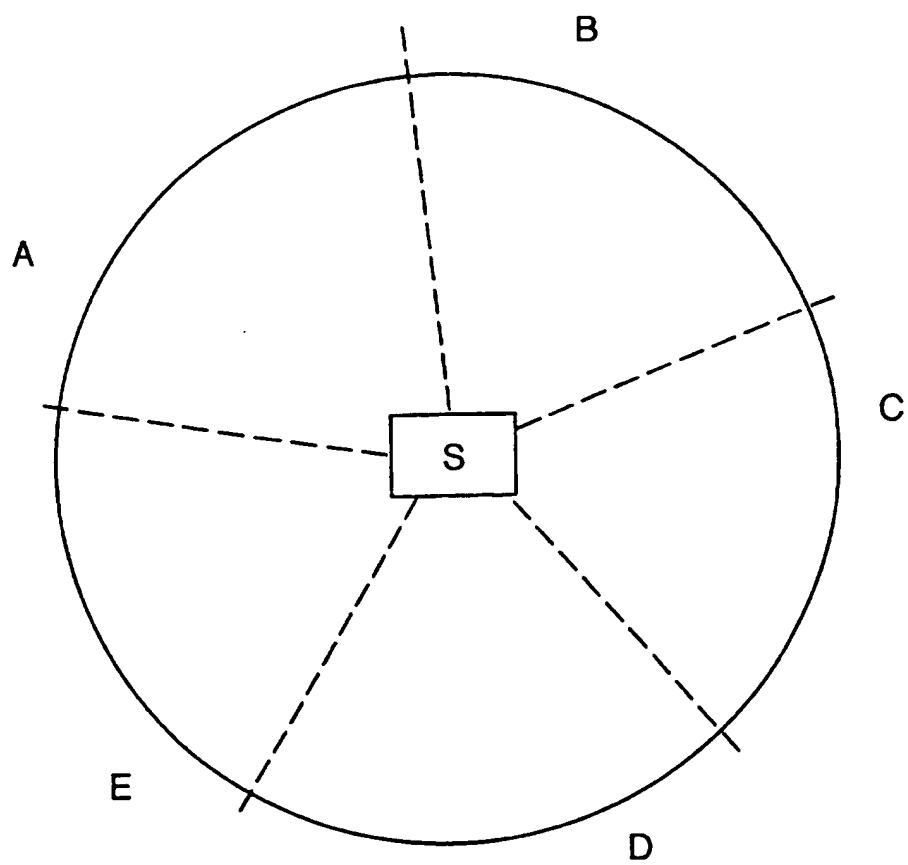


Fig. 2

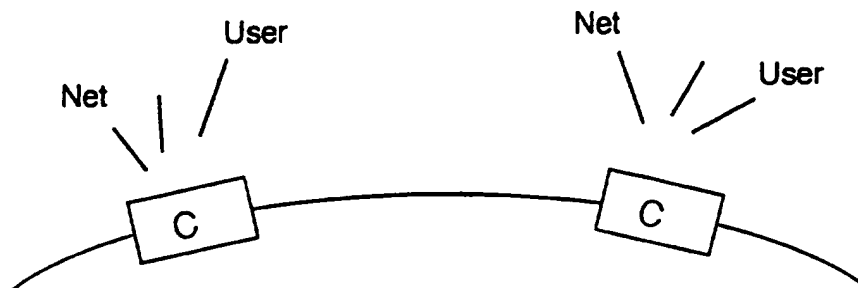


Fig. 3



Fig. 4



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/01075

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04L 5/22, H04L 29/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04L, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IEEE Communications Magazine p.66-73, Volume, October 1991, Aurel A. Lazar et al, "Control of Resources in Broadband Networks with Quality of Service Guarantees", page 72 - page 73, figure 13	1-2
Y	--	3-12
X	IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS s.968-981, Volume 9, No 7, Sept 1991, Roch Guerin et al, "Equivalent Capacity and Its Application to Bandwidth Allocation in High-Speed Networks", see whole document	1-2
Y	--	3-12

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

## \* Special categories of cited documents:

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6 March 1996

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International application No.

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS p.368-379, Volume 8, No 3, April 1990, Domenico Ferrari et al, "A Scheme for Real-Time Channel Establishment in Wide-Area Networks", see whole document, especially sections III C and V B	1-2,9-12
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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

05/02/96

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			JP-A-	2168797	28/06/90
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